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(54) DENTAL CLEANING DEVICE

(75) Inventors: Alexander Hilscher, Kronberg (DE); Hansjorg Reck, Steinbach (DE); Armin Schwarz-Hartmann, Wendelsheim (DE); Peter Trawinski, Weiterstadt (DE); Martin Stratmann, Frankfurt (DE); Wolfgang Vorbeck, Idstein-Eschenhahn (DE)

Correspondence Address:
The Gillette Company
Prudential Tower Building
Boston, MA 02199 (US)

(73) Assignee: Braun GmbH

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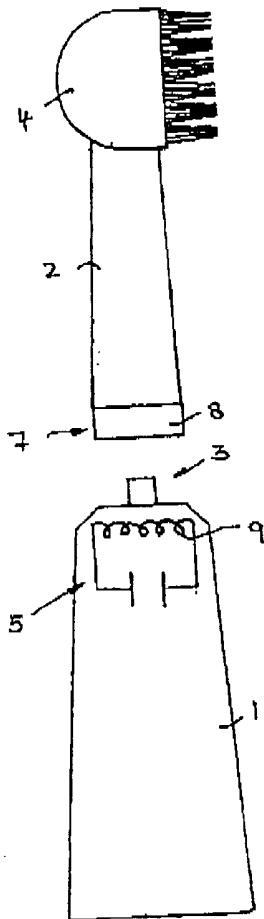
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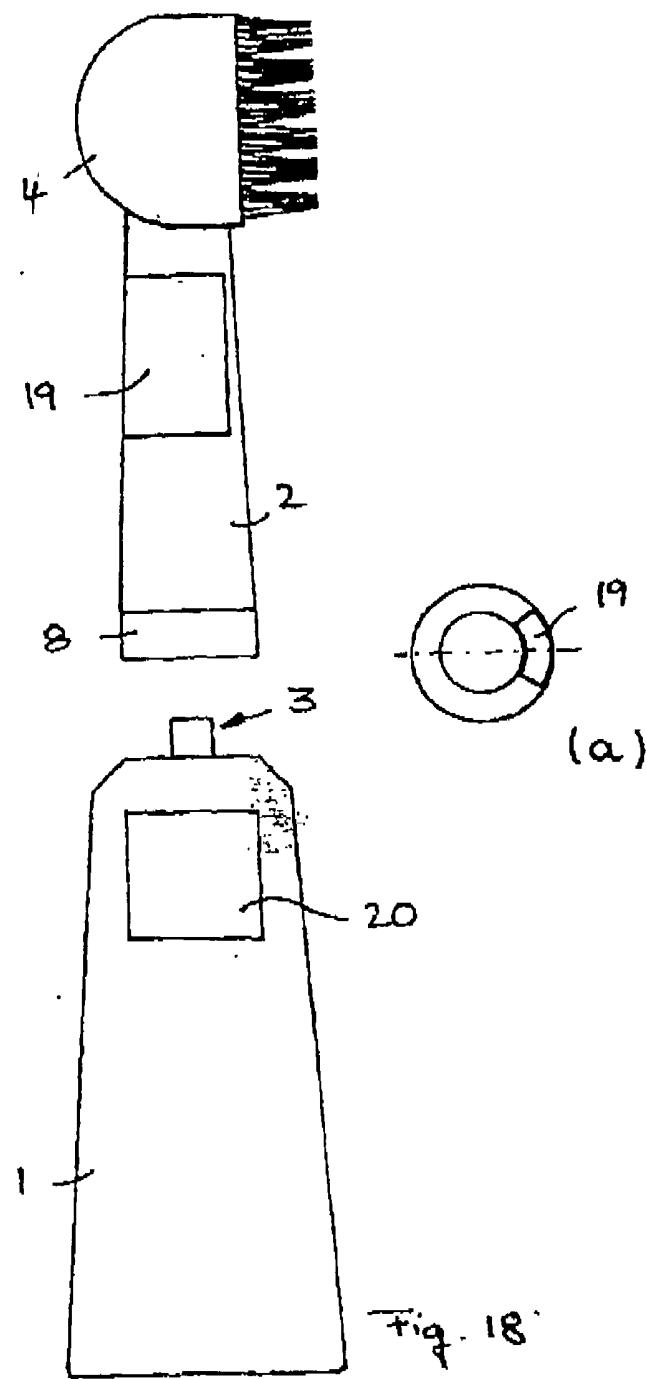
(57) ABSTRACT

The invention is directed to a dental cleaning device. It relates in particular to a handle section of an electric toothbrushing device, with a coupling section for coupling various cleaning tools thereto, a drive mechanism for driving the coupled cleaning tool, and a control device for controlling the drive mechanism. The invention further relates to such cleaning tools. According to the invention the handle section includes an electronic interlock device which is deactivated by an encoded interlock canceling element on the cleaning tool only when the cleaning tool is coupled to the handle section (FIG. 4).

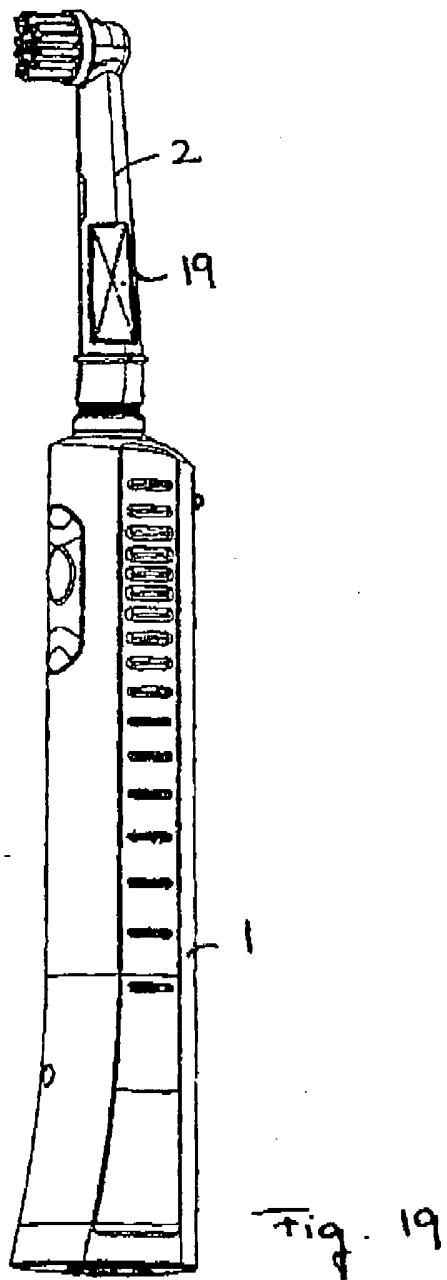


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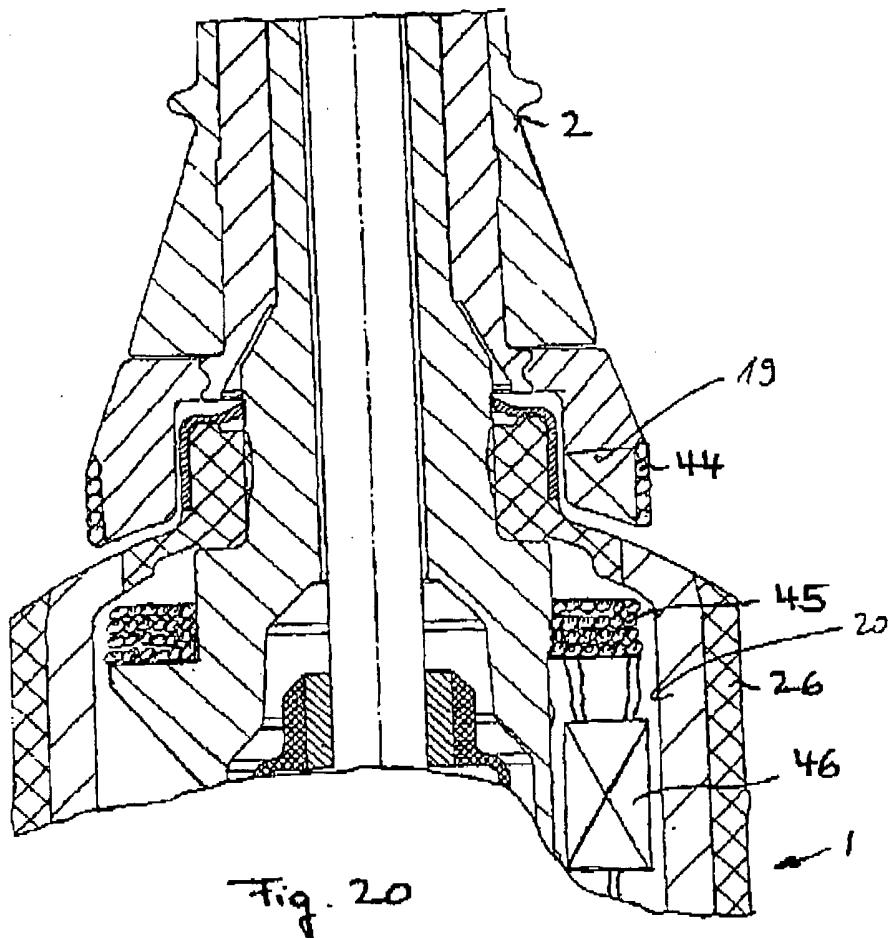
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handle section 1, through which membrane the mechanical contacts 17 can be actuated by the projections 16. To accomplish this the housing 26 may be a two-component injection molded part fabricated from hard and soft plastics material.

[0090] FIGS. 18 to 20 illustrate a further embodiment of an electric toothbrush in which the brush attachment 2 is detected, i.e., identified by means of radio signals. The brush attachment 2 is equipped with a transponder 19 which may be bonded by adhesion to or on the brush attachment 2 as in the form of a label referred to as smart label (FIG. 19). Advantageously, the transponder 19 may also be contained in the colored slip-on ring 8 at the end of the brush attachment 2 (cf. FIGS. 18a and 20). Provided in the handle section 1 is a detector 20 tuned to the transponder 19 and serving as both a signal transmitter and a signal receiver. Via the coil 45 the detector 20 in the handle section 1 initially emits electromagnetic waves to the coil 44 connected to the transponder 19 in order to supply power to the transponder 19 or its microchip. The transponder stores the energy and sends a specific identification back to the detector 20 which receives said identification, identifies it by means of its electronic evaluation device 46 and delivers a corresponding signal to the control device 27 of the handle section 1. The coils 44 and 45 hence serve as both transmitter and receiver facility. In a preferred embodiment the coils are disposed in relative opposite arrangement at the ends of the brush attachment 2 and the handle section 1, respectively (cf. FIG. 20). The identification sent back by the transponder 19 enables the brush attachment 2 to be identified.

[0091] In the embodiment of an electric toothbrush illustrated in FIGS. 21, 22 and 23, identification of the brush attachment 2 is performed capacitively. Provided in the handle section 1 are two or several capacitor plates 21 between which a dielectric 22 is insertable to vary the capacitance of the capacitor formed by the capacitor plates 21. The dielectric 22 is arranged at the end of the brush attachment 2, and it may be in particular part of a slip-on ring 8 suitable to the brush attachment 2. The dielectric portion 22 extends preferably approximately parallel to the longitudinal axis of the brush attachment, in particular approximately parallel to its circumferential surface. Provided in the circumferential surface of the handle housing 26 is an indentation 47 open towards the end and having the form of a longitudinally parallel groove suitable for engagement by the dielectric portion 22 of the brush attachment as it is being coupled to the handle section 1. The capacitor plates 21 are disposed in the interior of the housing 26 on either side of the indentation referred to so that the dielectric comes 10 lie between the capacitor plates. The use of different dielectrics makes it possible to encode the brush attachments 2 individually. Depending on the capacitance or the variation in capacitance by the different dielectrics, the corresponding brush attachment 2 can be identified. In an arrangement involving several capacitors, an encoding is also obtainable by the arrangement and/or number of dielectrics. It will be understood that the capacitance of the capacitor can also be varied by a variation in the distance between the capacitor plates 21, which is accomplishable by providing the brush attachment 2 with mechanical elements acting on the capacitor.

[0092] FIGS. 24 and 25 illustrate a specific embodiment of the invention involving a brush attachment encoded

mechanically, that is, by its shape, and a mechanical detection of this encoding. The encoding of the brush attachment is part of its coupling section 48 used for coupling the drive train 49 in the brush section with the drive shaft 28 in the handle section, to be more precise, with the coupling section 30 thereof. As FIG. 25 shows, the body of the brush attachment is seated onto a brush mount 50 of the handle section 1 with an exact fit so that the brush attachment sits on the handle section 1 in a defined position. By means of detent noses 10 and corresponding recesses the brush attachment is secured in place by making, for example, positive engagement with the handle section, that is, its brush mount. Axial securing can be accomplished also by frictional engagement. When the brush attachment is pushed onto its mount, the coupling sections 48 and 30 in the drive train also make interfitting engagement. The coupling sections are formed by a shaft stub and a complementary recess in the form of a blind-end hole in the opposite shaft end, thus enabling the shaft stub to be an exact fit within the blind-end type shaft bore. Torque transmission takes place preferably by positive engagement.

[0093] The coupling sections have complementary mating surfaces 51 and 52, preferably in the form of a flattening on the drive shaft 28 and a corresponding bore secant surface in the recess 53 of the drive shaft portion 54 of the brush attachment. A spline or a splined-shaft profile may also be provided for torque transmission.

[0094] The brush attachment, in particular the coupling section 48, has as encoding an actuating surface 55 which in coupled condition is in engagement with an associated engagement surface 56 face on the handle section 1, in particular on the coupling section 30 of the drive shaft 28. The actuating surface 55 mates with the engagement surface 56 in such manner that a predetermined interaction occurs between these two surfaces in coupled condition. In particular the actuating surface 55 is arranged and aligned so as to exert a predetermined pressure on the engagement surface 56. To be able to read or scan the configuration of the actuating surface 55, the associated engagement surface 56 is formed on a movable probe element, producing as interaction a predetermined movement of the probe element. It will be understood that it is also possible to detect a force, but a movement can be detected with greater ease. Different configurations of the actuating surfaces 55 are translated into different movements of the associated engagement surface 56 of the probe element.

[0095] As probe element the drive shaft 28 of the handle section is preferably used. The drive shaft is mounted longitudinally displaceably and preferably biased into protrusion from the handle section by means of biasing members. When the brush attachment 2 is seated down on the handle section the brush attachment's actuating surface 55 urges the drive shaft 28 a predetermined distance into the interior of the handle section 1. The displacement is detected by a displacement or motion sensor which may embody a variety of configurations, being operable for example as a light barrier. Other displacement sensors may also be employed. Preferably provision may be made for an elastically deformable sensing element with electromechanical contact of the type previously described with reference to FIG. 17. The drive shaft 28 preferably sits with a lug, preferably with its end remote from the coupling section 30, on the sensing element 57. The sensing element may at the